

MATHEMATICS AND SCIENCE EDUCATION RESEARCH GRANTS

CFDA NUMBER: 84.305

RELEASE DATE: October 22, 2003

REQUEST FOR APPLICATIONS: NCER-04-03

Institute of Education Sciences

<http://www.ed.gov/programs/edresearch/applicant.html>

LETTER OF INTENT RECEIPT DATE: November 20, 2003

APPLICATION RECEIPT DATE: January 8, 2004

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1. REQUEST FOR APPLICATIONS

The Institute of Education Sciences (Institute) invites applications for research projects that will contribute to its research program on Mathematics and Science Education. For this competition, the Institute will consider only applications that meet the requirements outlined below under the section on Requirements of the Proposed Research.

## 2. PURPOSE OF THE RESEARCH PROGRAM

The Institute intends for the research program on Mathematics and Science Education (Math/Science) to fulfill three goals: (a) to support the development of new interventions and approaches to mathematics and science education that will eventually result in improving mathematics and science achievement; (b) to establish the efficacy of existing interventions and approaches to mathematics and science education with small efficacy or replication trials; and (c) to provide evidence on the effectiveness of mathematics and science interventions taken to scale. The long-term outcome of this program will be an array of tools and strategies (e.g., curricula, programs) that have been demonstrated to be effective for improving mathematics and science learning and achievement.

## 3. BACKGROUND

Education, science, and technology policy in the United States has included a concern about the mathematics and science achievement of our nation's youth since the aftermath of the Soviet Union's launching of Sputnik in 1957. This concern has increased in recent years for reasons of national security and economic competitiveness and arises from two primary perspectives. First, in our technology-driven society, the general population needs to be more proficient in mathematics and science than previous generations – not only for purposes of employment but to participate as informed citizens in public discussions, for example, of ethical issues rising out of medical and biotechnological advances or on issues of privacy, security, and copyright driven by a rapidly changing Internet environment (Research & Policy Committee of the Committee for Economic Development, 2003).

Second, on the high-end of mathematics and science achievement, our country faces shortages of domestic scientists and technological professionals in critical areas of science, engineering, and technology. Higher proportions of college students in many other countries graduate with degrees in the sciences, mathematics, and engineering than in our country (U.S. Department of Education, 2002). For example, in 1999, 17% of the bachelor's degrees awarded in the U.S. were in science, mathematics or engineering. In contrast, 25% to 30% of the bachelor's degrees were awarded in these fields in a number of European, Asian, and Scandinavian countries. The comparison is more dramatic at the graduate level. In 1999, about 14% of all graduate degrees awarded in the U.S. were in mathematics, sciences, and engineering. In contrast, 30% to 48% of the graduate degrees awarded in Austria, Germany, Iceland, Japan, Korea, Spain, Sweden, and Switzerland were in these fields. Further, 37% of the students enrolled in graduate mathematics, sciences, and engineering programs in the U.S. in 2000 were international students on temporary visas (National Science Foundation, 2000).

Current levels of mathematics and science achievement at the elementary and secondary levels suggest that we are neither preparing the general population with levels of mathematics and science knowledge necessary for the 21<sup>st</sup> century workplace, nor producing an adequate pipeline to meet national needs for domestic scientists and mathematicians. In the 2000 National Assessment of Educational Progress (NAEP), only two percent of U.S. students attained advanced levels of mathematics or science achievement by Grade 12. In mathematics, large numbers of U.S. students continue to score below the basic level. Thirty-one percent of grade 4 students, thirty-four percent of grade 8, and thirty-five percent of grade 12 students scored below the "basic" level. At Grade 4 scoring below the basic level means that the student is likely to

miss problems such as using a ruler to find the total length of three line segments. At Grade 12 scoring below the basic level means that the student is unlikely to be able to solve problems such as finding the perimeter of a figure. Despite the fact that levels of mathematics achievement have improved over the past decade, achievement gaps remain wide with low levels of achievement being more likely among minority groups and students from low-income backgrounds

As in mathematics, many U.S. students are not attaining mastery of rudimentary science knowledge and skills. In the 2000 NAEP, 34 percent of grade 4 students, 39 percent of grade 8 students and 47 percent of grade 12 students scored below the “basic” level in science. At Grade 4, students performing below the basic level cannot read simple graphs. At Grade 12, students performing below the basic level are likely to miss problems such as drawing a simple diagram of the solar system. On the 2000 NAEP, only 22% of all Grade 12 students demonstrated knowledge of the essential features and function of genes – that is, that genes determine our individual characteristics and are made up of strands of DNA. As in mathematics, low levels of achievement are more likely among minority groups and students from low-income backgrounds.

In recent years there has been much disagreement about how to improve mathematics and science education in order to raise achievement levels. At issue in mathematics education are fundamentals such as what constitutes mathematics proficiency and which teaching methods support student achievement of this proficiency. Although there has been much debate, very little empirical research has been conducted to determine if one approach or another or some combination of approaches leads to improved mathematics achievement across ethnic, racial, and socioeconomic groups in our country. In science education there has been more agreement about what to teach but there are disagreements about the time and place for hands-on learning. Very little empirical evidence has accumulated showing the effectiveness of particular science curricula or approaches to teaching science.

Over the past 20 years, cognitive and developmental researchers have described the growth of young children's scientific knowledge and numeracy. In mathematics, for example, researchers have described the development of children's knowledge of number, quantity, and basic operations. In the sciences, researchers have examined how knowledge develops in particular scientific domains and described the development of children's naive theories in the domains of physics, biology, and psychology. Cognitive scientists and cognitive developmental researchers have built bodies of research describing the development of general cognitive processes critical to scientific thinking, identifying basic principles of learning, and elaborating distinct differences in the ways that experts and novices organize scientific knowledge. However, it is not evident that curricula in mathematics and the sciences and approaches to mathematics and science instruction have incorporated findings from this accumulation of research. In addition, little work has been conducted to evaluate the effectiveness of mathematics and science curricula and instructional practice for improving student learning and achievement. To address these needs, the Institute seeks to fund applications that address one of the three following goals.

#### 4. REQUIREMENTS OF THE PROPOSED RESEARCH

For the 2004 Math/Science competition, applicants must submit under *either* Goal One *or* Goal Two *or* Goal Three. Applicants should indicate the goal under which they are applying in the

abstract. Goal One addresses development of new interventions in mathematics or science education, with preliminary testing of effects. Goal Two is to establish the efficacy of existing mathematics or science education interventions with small-scale efficacy or replication trials. Goal Three targets evaluations of mathematics or science education interventions taken to scale. The three goals can be seen as a progression from development (Goal 1), to efficacy (Goal 2), to effectiveness at scale (Goal 3).

Applicants to Goal One and Goal Two must target students at any level from pre-kindergarten through Grade 12. Applicants to Goal Three must target students at any level from pre-kindergarten through post-secondary.

Please note that the Institute intends research under the Math/Science program to address questions related to the effectiveness of mathematics and science curricula and instructional approaches – that is, what is being manipulated or varied is what students receive. Applicants who are interested in conducting research on different approaches to professional development for those who teach mathematics or science should see the Institute’s research program on Teacher Quality (<http://www.ed.gov/programs/edresearch/applicant.html>). Researchers who are interested in other questions related to mathematics and science learning are encouraged to consider the Institute's Cognition and Student Learning research program (<http://www.ed.gov/programs/edresearch/applicant.html>), research programs in the National Science Foundation's Directorate for Social, Behavioral, and Economic Sciences (<http://nsf.gov/home/sbe/>) and Directorate for Education and Human Resources (<http://nsf.gov/home/ehr/>), and the National Institute of Child Health and Human Development's Program in Mathematics and Science Cognition and Learning – Development and Disorders (<http://www.nichd.nih.gov/crmc/cdb/math.htm>).

*Applications under Goal One (Development).* Applications are requested that develop interventions (curricula or instructional approaches) for improving student learning in mathematics or science and assess the potential of these interventions for improving mathematics or science achievement among students from low-income backgrounds and/or racial, ethnic, and linguistic minority groups that have underachieved academically.

Under Goal One, the Institute will consider interventions that are in the early stages of development (e.g., those that do not have an entire curriculum ready to evaluate). Applicants must provide a strong rationale to support the use of the proposed curriculum or instructional practice (e.g., what is the theoretical foundation for the proposed intervention; what empirical evidence suggests that the proposed intervention would improve student learning if used). This rationale should also address the *practical* importance of the proposed intervention. For example, would the planned curriculum materials, when fully developed, form an instructional sequence that covers educationally meaningful components of a math or science curriculum (e.g., a set of lessons that would comprise a chapter of a math textbook)? Appropriate applications for Goal One may include, for example, proposals to develop and test curriculum materials that ultimately could be combined to form a complete curriculum for a grade. To assess the potential efficacy of the curriculum materials, researchers might propose, for instance, a series of design studies in which the researcher uses the curriculum materials to teach a four-week unit to a 5<sup>th</sup> grade class. The researcher would also collect pre- and post-test data of

student learning to compare to a class of similar students using their regular textbook to cover the same content and collect other data (e.g., classroom observational data) to help refine the materials. For this example, a successful project might be one that (a) develops, tests, refines, and tests again a set of math or science curriculum components; (b) results in a math or science curriculum that would cover a semester for a given grade; and (c) accumulates preliminary evidence suggesting that these materials have potential to improve math or science learning.

Typical awards for projects at this level are \$150,000 to \$500,000 (total cost) per year for 2 to 3 years. The size of the award depends on the scope of the project.

*Applications under Goal Two (Efficacy and Replication Trials).* Applicants who have already developed a mathematics or science intervention should provide a strong rationale, including some preliminary empirical evidence, to support the efficacy of the intervention. The goal of projects at this level is to demonstrate the efficacy of interventions in a limited number of settings. For example, preliminary empirical evidence cited in the application could consist of data based on a single-group, pre-test/post-test study and a reasonable next step would be to demonstrate the efficacy of the intervention in a randomized trial using 10 to 20 classrooms. As another example, the preliminary evidence could be a small randomized trial in 3 or 4 schools in an urban school district, and a reasonable next step would be to replicate these findings in a poor rural school district. Applicants should propose studies to determine the degree to which these interventions are effective when implemented in typical education delivery settings (i.e., not by researchers or developers of the intervention). Researchers should attend to questions of implementation and how best to train and support teachers or other personnel who will support the students to whom these interventions are delivered. Because these studies focus on identifying the causal effects of mathematics or science interventions, experimental designs using random assignment are strongly preferred. Applicants proposing to use other approaches, such as quasi-experiments with matched groups and statistical controls, should carefully justify their approach in terms of the ability to make causal inferences, and should provide a compelling rationale for why random assignment is impossible or inappropriate. Observational, survey, or qualitative methodologies are encouraged as a complement to experimental methodologies to assist in the identification of factors that may explain the effectiveness or ineffectiveness of the intervention. Proposals should provide research designs that permit the identification and assessment of factors impacting the fidelity of implementation. Mediating and moderating variables that are measured in the intervention condition that are also likely to affect outcomes in the comparison condition should be measured in the comparison condition (e.g., student time-on-task, teacher experience/time in position). For all proposals under Goal Two, outcome measures of mathematics or science learning should include standardized assessments of mathematics or science achievement.

Competitive applicants will have research teams that collectively demonstrate expertise in the academic content domain (e.g., mathematics, biology), implementation and analysis of results from the research design that will be employed, and working with teachers, schools, or other education delivery settings that will be employed.

Typical awards for projects at this level will be \$250,000 to \$750,000 (total cost) per year for up to 3 years. Larger budgets will be considered if a compelling case can be made for such support. The size of the award depends on the scope of the project.

*Applications under Goal Three (Large scale evaluations of the effectiveness of mathematics or science interventions)* . Goal Three reflects the priorities of the Interagency Education Research Initiative (IERI), a joint research initiative sponsored by the Institute of Education Sciences, the National Science Foundation (NSF), and the National Institute of Child Health and Human Development (NICHD). The goal of IERI is to support scientific research that (a) investigates the effectiveness of education interventions in reading, mathematics, and the sciences as they are implemented in varied school and education delivery settings with diverse student populations and (b) identifies conditions under which effective evidence-based interventions (i.e., interventions which have been shown through randomized field trials or well-designed quasi-experimental evaluations to improve student learning and achievement) succeed when applied on a large scale.

In FY 2004, the agencies are holding IERI competitions within the context of each agency's research competitions that reflect the agency's particular research mission. For information on the NICHD IERI competition, applicants should contact Dr. Daniel Berch (Phone: 301-402-0699; Email: berchd2@mail.nih.gov). For information on the NSF IERI competition, applicants should contact Dr. Finbarr Sloane (Phone: 703-292-5146; Email: fsloane@nsf.gov). The Institute will accept IERI applications through three of its research competitions – reading comprehension and reading intervention scale-up (Reading), math and science education (Math/Science), and teacher quality (Teacher Quality). For information on the Reading or Teacher Quality research programs, please see the Institute website <http://www.ed.gov/programs/edresearch/applicant.html>.

Under Goal Three of the Math/Science research program, the Institute invites applicants for its IERI mathematics and science education competition to propose large scale evaluations of mathematics or science education interventions and approaches at any grade from pre-kindergarten through post-secondary.

*Requirements for proposed IERI intervention:* To be considered for IERI awards, applicants must provide a strong rationale for the *practical* importance of the intervention. The critical question is whether the intervention is likely to produce educationally meaningful effects on outcomes that are important to educational achievement (e.g., grades, achievement test scores) and, therefore, are of interest to parents, teachers, and education decision makers. Interventions appropriate for study under IERI may be (a) interventions that have not yet been applied on a large scale but have evidence of effectiveness on a limited scale or (b) interventions that are already widely used in the U.S. but lack evidence of effectiveness at scale.

Applicants who propose to evaluate the effectiveness of a program or intervention that is already widely used (i.e., has already been scaled-up) must provide a strong justification for evaluating the program based on the implications for education practice and policy that would result from

conducting a rigorous evaluation of the program. In addition, applicants must provide documentation of the widespread use of the program.

Applicants who propose to study the scale-up of a program that has not yet been implemented widely must provide evidence of the efficacy of the program as implemented on a small scale. That evidence should be based on the results of randomized field trials, or well-designed quasi-experimental evaluations. A well-designed quasi-experiment is one that reduces substantially the potential influence of selection bias on membership in the intervention or comparison group. This involves demonstrating equivalence between the intervention and comparison groups at program entry on the variables that are to be measured as program outcomes (e.g., math achievement test scores), or obtaining such equivalence through statistical procedures such as propensity score balancing or regression. It also involves demonstrating equivalence or removing statistically the effects of other variables on which the groups may differ and that may affect intended outcomes of the program being evaluated (e.g., demographic variables, experience and level of training of teachers, motivation of parents or students). Finally, it involves a design for the initial selection of the intervention and comparison groups that minimizes selection bias or allows it to be modeled. For example, a very weak quasi-experimental design that would *not* be acceptable as evidence of program efficacy would populate the intervention condition with students who volunteered for the program to be evaluated, and would select comparison students who had the opportunity to volunteer but did not. In contrast, an acceptable design would select students in one particular geographical area of a city to be in the intervention; whereas students in another geographical area, known to be demographically similar, would be selected to be in the comparison condition. In the former case, self-selection into the intervention is very likely to reflect motivation and other factors that will affect outcomes of interest and that will be impossible to equate across the two groups. In the latter case, the geographical differences between the participants in the two groups would ideally be unrelated to outcomes of interest, and in any case, could be measured and controlled for statistically.

*IERI methodological requirements:* Studies using randomized assignment to treatment and comparison conditions are strongly preferred. In circumstances in which a randomized trial is not possible, alternatives that substantially minimize selection bias or allow it to be modeled can be employed. Such alternatives include appropriately structured regression-discontinuity designs and natural experiments in which naturally occurring circumstances or institutions (perhaps unintentionally) divide people into treatment and comparison groups in a manner akin to purposeful random assignment. Applicants proposing to use other than a randomized design must, first, make a compelling case that randomization is not possible and, second, describe in detail the procedures to be used that will result in substantially minimizing the effects of selection bias on estimates of effect size. Choice of randomizing unit or units (e.g., students, classrooms, schools) must be grounded in a theoretical framework. Observational, survey, or qualitative methodologies are encouraged as a complement to experimental methodologies to assist in the identification of factors that may explain the effectiveness or ineffectiveness of the intervention. Proposals should provide research designs that permit the identification and assessment of factors impacting the fidelity of implementation. Mediating and moderating variables that are measured in the intervention condition that are also likely to affect outcomes in

the comparison condition should be measured in the comparison condition (e.g., student time-on-task, teacher experience/time in position).

One goal of IERI evaluations is to determine if programs are effective when implemented at a distance from the developers of the program and with no more support from the developers of the program than would be available under normal conditions. A second goal is to determine if programs implemented under these conditions are effective in a variety of settings. The scope of IERI projects may vary. A smaller project might involve several schools within a large urban school district in which student populations vary in terms of SES, race, and ethnicity. A larger project might involve large numbers of students in several school districts in different geographical areas. Budget should vary with scope.

The applicant must provide a detailed research design and describe how potential threats to internal and external validity will be addressed. The applicant must define, as completely as possible, the sample to be selected and sampling procedures to be employed for the proposed study. Additionally, the applicant should show how the long-term participation of those sampled would be assured. The applicant must supply information on the reliability, validity, and appropriateness of proposed measures. If the reliability and validity of the measurement, assessment, or observational procedures are initially unknown, the applicant must include specific plans for establishing these measurement properties. Measures of student achievement must include standardized measures of learning and achievement. The applicant must specify how the implementation of the intervention will be documented and measured. The proposal should either indicate how the intervention will be maintained consistently across multiple classrooms and schools over time or describe the parameters under which variations in the intervention may be described. All proposals should provide detailed descriptions of data analysis procedures. For quantitative data, specific statistical procedures should be cited. For qualitative data, the specific methods used to index, summarize, and interpret data should be delineated. In addition, documentation of the resources required to implement the program and a cost analysis need to be part of the study.

The evaluation must be designed to account for sources of variation in outcomes across settings (i.e., to account for what might otherwise be part of the error variance). Applicants should provide a theoretical rationale to justify the inclusion (or exclusion) of factors/variables in the design of the evaluation that have been found to affect the success of education programs (e.g., teacher experience, fidelity of implementation, characteristics of the student population). The research should demonstrate the conditions and critical variables that affect the success of a given intervention. The most scalable interventions are those that can produce the desired effects across a range of education contexts.

Given the complexity of the project, competitive applicants will have research teams that collectively demonstrate expertise in the academic content area of the program (i.e., mathematics or the sciences), implementation and analysis of results from the research design that will be employed, and working with teachers, schools, or other education delivery settings that will be employed. An applicant may involve curriculum developers or distributors in the project, from having the curriculum developers as full partners in its proposal to using off-the-shelf curriculum materials without involvement of the developer or publisher. Involvement of the curriculum



developer or distributor must not jeopardize the objectivity of the evaluation. Collaborations including for-profit distributors of curriculum materials should justify the need for Federal assistance to undertake the evaluation of programs that are marketed to consumers and consider cost-sharing part of the cost of the evaluation.

Applicants are required to document the availability and cooperation of the schools or other education delivery settings that will be required to carry out the research proposed in the application via a letter of support from the education organization(s).

Applicants for projects at this level may request funds for up to 5 years with total funding over the period *not to exceed* \$6,000,000 (total cost). The size of the award depends on the scope of the project.

#### 5. APPLICATIONS AVAILABLE

Application forms and instructions for the electronic submission of applications will be available for this program of research no later than December 9, 2003, from the following web site:

<http://ies.constellagroup.com>

#### 6. MECHANISM OF SUPPORT

The Institute intends to award grants for periods up to 5 years pursuant to this request for applications. Please see specific details for each goal in the Requirements of the Proposed Research section of the announcement.

#### 7. FUNDING AVAILABLE

The size of the award depends on the scope of the project. Please see specific details in the Requirements of the Proposed Research section of the announcement. Although the plans of the Institute include this program of research, awards pursuant to this request for applications are contingent upon the availability of funds and the receipt of a sufficient number of meritorious applications. The number of projects funded under a specific goal depends upon the number of high quality applications submitted to that goal. The Institute does not have plans to award a specific number of grants under each particular goal.

#### 8. ELIGIBLE APPLICANTS

Applicants that have the ability and capacity to conduct scientifically valid research are eligible to apply. Eligible applicants include, but are not limited to, non-profit and for-profit organizations and public and private agencies and institutions, such as colleges and universities.

#### 9. SPECIAL REQUIREMENTS

Research supported through this program must be relevant to U.S. schools. Recipients of awards are expected to publish or otherwise make publicly available the results of the work supported through this program.

Applicants should budget for one meeting each year in Washington, DC, with other grantees and Institute staff. At least one project representative should attend the two-day meeting.

If the applicant has a negotiated off-campus indirect cost rate with the U.S. Department of Health and Human Services or other cognizant federal agency, the applicant must apply that off-campus indirect rate, proportional to the activities (including implementation of an intervention, if one is proposed) that will be conducted off-campus under the applicant's proposal.

#### 10. LETTER OF INTENT

A letter indicating a potential applicant's intent to submit an application is optional, but encouraged, for each application. The letter of intent must be submitted electronically by the date listed at the beginning of this document, using the instructions provided at the following web site:

<http://ies.constellagroup.com>

The letter of intent should include a descriptive title, the goal which the application will address, and brief description of the research project (no longer than one page, single-spaced, using a 12 point font without compression or kerning); the name, institutional affiliation, address, telephone number and e-mail address of the principal investigator(s); and the name and institutional affiliation of any key collaborators. The letter of intent should indicate the duration of the proposed project and provide an estimated budget request by year, and a total budget request. Although the letter of intent is optional, is not binding, and does not enter into the review of subsequent applications, the information that it contains allows Institute staff to estimate the potential workload to plan the review.

#### 11. SUBMITTING AN APPLICATION

Applications must be submitted **electronically by 8:00 p.m. Eastern time** on the application receipt date, using the ED standard forms and the instructions provided at the following web site:

<http://ies.constellagroup.com>

Application forms and instructions for the electronic submission of applications will be available for this program of research no later than **December 9, 2003**. Potential applicants should check this site for information about the electronic submission procedures that must be followed and the software that will be required.

The application form approved for this program is OMB Number 1890-0009.

#### 12. CONTENTS AND PAGE LIMITS OF APPLICATION

All applications and proposals for Institute funding must be self-contained within specified page limitations. Internet Web site addresses (URLs) may not be used to provide information necessary to the review because reviewers are under no obligation to view the Internet sites.

Sections described below, and summarized in Table 1, represent the body of a proposal submitted to the Institute and should be organized in the order listed below. Sections a (ED 424) through h (Appendix A) are required parts of the proposal. Section i (Appendix B) is optional. All sections must be submitted electronically.

Observe the page number limitations given in Table 1.

**Table 1**

<b>Section</b>	<b>Page Limit</b>	<b>Additional Information</b>
a. Application for Federal Education Assistance (ED 424)	n/a	
b. Budget Information Non-Construction Programs (ED 524)	n/a	
c. Project Abstract	1	
d. Research Narrative	20	Figures, charts, tables, and diagrams may be included in Appendix A
e. Reference List	no limit	Complete citations, including titles and all authors
f. Curriculum Vita of Key Personnel	3	No more than 3 pages for each key person
g. Budget Narrative	no limit	
h. Appendix A	10	
i. Appendix B	15	

- a. *Application for Federal Education Assistance (ED 424)*. The form and instructions are available on the website.
- b. *Budget Information Non-Construction Programs (ED 524)*. The application must include a budget for each year of support requested and a cumulative budget for the full term of requested Institute support. Applicants must provide budget information for each project year using the ED 524 form (a link to the form is provided on the application website at <http://ies.constellagroup.com>). ED 524 form has three sections: A, B, and C. Instructions for Sections A and B are included on the form. Instructions for Section C are as follows. Section C must provide an itemized budget breakdown for each project year, for each budget category listed in Sections A and B. Section C may be submitted as an Excel spreadsheet with an itemized listing of project costs. For personnel, include a listing of percent effort for each project year, as well as the cost. Section C should also include a breakdown of the fees to consultants, a listing of each piece of equipment, itemization of supplies into separate categories, and itemization of travel requests (e.g. travel for data collection, conference travel, etc.) into separate categories. Any other expenses should be itemized by category and unit cost.
- c. *Project abstract*. The abstract is limited to one page and must include: (1) The title of the project; (2) the RFA goal under which the applicant is applying; and brief descriptions of (3) the potential contribution the proposed project will make to the solution of an education problem; (4) the population(s) from which the participants of the study(ies) will be sampled (age groups, race/ethnicity, SES); (5) the proposed research method(s); and (6) the proposed intervention if one has been proposed.

- d. *Research narrative.* Incorporating the requirements outlined under the section on Requirements of the Proposed Research, the *research narrative* provides the majority of the information on which reviewers will evaluate the proposal and should include the following sections (1 through 4) in the order listed:

(1) Contribution of Project to Solving an Education Problem (suggested: 1-2 pages)

Identify the education problem that will be addressed by the study and describe the contribution the study will make to a solution to that problem.

(2) Research Plan (suggested: 14-17 pages)

- i. Provide a compelling rationale addressing, where applicable, the theoretical foundation, relevant prior empirical evidence supporting the proposed project, and the practical importance of the proposed project.

For projects in which an intervention is proposed, include a description of the intervention along with the conceptual rationale and empirical evidence supporting the intervention. (Applicants proposing an intervention may use Appendix B to include up to 10 pages of examples of curriculum material, computer screens, or further description of the intervention);

- ii. Include clear, concise hypotheses or research questions;
- iii. Present a clear description of, and a rationale for, the sample or study participants, including justification for exclusion and inclusion criteria and, where groups or conditions are involved, strategies for assigning participants to groups;
- iv. Provide clear descriptions of, and rationales for, data collection procedures and measures to be used; and
- v. Present a detailed data analysis plan that justifies and explains the selected analysis strategy, shows clearly how the measures and analyses relate to the hypotheses or research questions, and indicates how the results will be interpreted. Quantitative studies should, where sufficient information is available, include a power analysis to provide some assurance that the sample is of sufficient size.

(3) Personnel (suggested: 1-2 pages)

Include brief descriptions of the qualifications of key personnel (information on personnel should also be provided in their curriculum vitae).

(4) Resources (suggested: 1-2 pages)

Provide a description of the resources available to support the project at the applicant's institution and in the field settings in which the research will be conducted.

The research narrative is limited to the equivalent of 20 pages, where a “page” is 8.5 in. x 11 in., on one side only, with 1 inch margins at the top, bottom, and both sides. Single space all text in the research narrative. To ensure that the text is easy for reviewers to read and that all applicants have the same amount of available space in which to describe their projects, applicants must adhere to the type size and format specifications for the entire research narrative including footnotes, or the application will be returned without review. See frequently asked questions available at <http://ies.constellagroup.com> on or before December 9, 2003.

Conform to the following four requirements:

- (1) The height of the letters must not be smaller than 12 point;
- (2) Type density, including characters and spaces, must be no more than 15 characters per inch (cpi). For proportional spacing, the average for any representative section of text must not exceed 15 cpi;
- (3) No more than 6 lines of type within a vertical inch;
- (4) Margins, in all directions, must be at least 1 inch.

Applicants should check the type size using a standard device for measuring type size, rather than relying on the font selected for a particular word processing/printer combination. Figures, charts, tables, and figure legends may be smaller in size but must be readily legible. The type size used must conform to all four requirements. Small type size makes it difficult for reviewers to read the application; consequently, the use of small type will be grounds for the Institute to return the application without peer review. Adherence to type size and line spacing requirements is also necessary so that no applicant will have an unfair advantage, by using small type, or providing more text in their applications.

**Note, these requirements apply to the PDF file as submitted.** As a practical matter, applicants who use a 12 point Times New Roman without compressing, kerning, condensing or other alterations typically meet these requirements.

Use only black and white in graphs, diagrams, tables, and charts. The application must contain only material that reproduces well when photocopied in black and white.

The 20-page limit does *not* apply to the ED 424 form, the one-page abstract, the ED 524 form and narrative budget justification, the curriculum vitae, or reference list. Reviewers are able to conduct the highest quality review when applications are concise and easy to read, with pages numbered consecutively.

- e. *Reference list.* Please include complete citations, including titles and all authors, for literature cited in the research narrative.
- f. *Brief curriculum vita of key personnel.* Abbreviated curriculum vita should be provided for the principal investigator(s) and other key personnel. Each vitae is limited to 3 pages

and should include information sufficient to demonstrate that personnel possess training and expertise commensurate with their duties. The curriculum vita must adhere to the margin, format, and font size requirements described in the research narrative section.

- g. *Budget justification.* The *budget justification* must provide sufficient detail to allow reviewers to judge whether reasonable costs have been attributed to the project. It must include the time commitments and brief descriptions of the responsibilities of key personnel. *The budget justification should correspond to the itemized breakdown of project costs that is provided in Section C.* For consultants, the narrative should include the number of days of anticipated consultation, the expected rate of compensation, travel, per diem, and other related costs. A justification for equipment purchase, supplies, travel and other related project costs should also be provided in the budget narrative for each project year outlined in Section C. For applications that include contracts for work conducted at collaborating institutions, applicants should submit an itemized budget spreadsheet for each contract for each project year, and the details of the contract costs should be included in the budget narrative. Applicants should use their institution's federal indirect cost rate and use the off-campus indirect cost rate where appropriate (see instructions under Section 9 Special Requirements). If less than 75 percent of total indirect costs are based on application of the off-campus rate, the applicant must provide a detailed justification.
- h. *Appendix A.* In *Appendix A*, the applicant may include any figures, charts, or tables that supplement the research text, and letters of agreement from all partners (e.g., schools) and consultants. Letters of agreement should include enough information to make it clear that the author of the letter understands the nature of the commitment of time, space, and resources to the research project that will be required if the application is funded. The appendix is limited to 15 pages.
- i. *Appendix B (optional).* For proposals in which an intervention is proposed, applicants may include in *Appendix B* up to 10 pages of examples of curriculum material, computer screens, or further description of the intervention.

Please note that applicants selected for funding will be required to submit the following certifications and assurances before a grant is issued:

- (1) SF 424B-Assurances-Non-Construction Programs
- (2) ED-80-0013-Certification Regarding Lobbying, Debarment, Suspension and other Responsibility
- (3) Matters; and Drug-Free Workplace Requirements
- (4) ED 80-0014 (if applicable)-Lower Tier Certification
- (5) SF-LLL (if applicable) - Disclosure of Lobbying Activities

### 13. APPLICATION PROCESSING

Applications must be received by **8:00 p.m. Eastern time** on the application receipt date listed in the heading of this request for applications. Upon receipt, each application will be reviewed

for completeness and for responsiveness to this request for applications. Applications that do not address specific requirements of this request will be returned to the applicants without further consideration.

#### 14. PEER REVIEW PROCESS

Applications that are complete and responsive to this request will be evaluated for scientific and technical merit. Reviews will be conducted in accordance with the review criteria stated below by a panel of scientists who have substantive and methodological expertise appropriate to the program of research and request for applications.

Each application will be assigned to at least two primary reviewers who will complete written evaluations of the application, identifying strengths and weaknesses related to each of the review criteria. Primary reviewers will independently assign a score for each criterion, as well as an overall score, for each application they review. Based on the overall scores assigned by primary reviewers, an average overall score for each application will be calculated and a preliminary rank order of applications prepared before the full peer review panel convenes to complete the review of applications.

The full panel will consider only those applications deemed to have the highest merit, as reflected by the preliminary rank order, generally the top 30, and the most competitive proposals will be discussed and scored.

#### 15. REVIEW CRITERIA FOR SCIENTIFIC MERIT

The goal of Institute-supported research is to contribute to the solution of education problems and to provide reliable information about the education practices that support learning and improve academic achievement and access to education for all students. Reviewers will be expected to assess the following aspects of an application in order to judge the likelihood that the proposed research will have a substantial impact on the pursuit of that goal. Information pertinent to each of these criteria is also described above in the section on Requirements of the Proposed Research and in the description of the research narrative, which appears in the section on Contents and Page Limits of Application.

Significance	Does the applicant make a compelling case for the potential contribution of the project to the solution of an education problem?
Research Plan	Does the applicant present (a) a strong rationale for the project; (b) clear hypotheses or research questions; (c) clear descriptions of and strong rationales for the sample, the measures, data collection procedures, and research design; and (d) a detailed and well-justified data analysis plan? Does the research plan meet the requirements described in the section on the Requirements of the Proposed Research and in the description of the research narrative in the section on Contents and Page Limits? Is the research plan appropriate for answering the research questions or testing the proposed hypotheses?

- Personnel Does the description of the personnel make it apparent that the principal investigator, project director, and other key personnel possess the training and experience and will commit sufficient time to competently implement the proposed research?
- Resources Does the applicant have the facilities, equipment, supplies, and other resources required to support the proposed activities? Do the commitments of each partner show support for the implementation and success of the project?

#### 16. RECEIPT AND REVIEW SCHEDULE

Letter of Intent Receipt Date: November 20, 2003

Application Receipt Date: January 8, 2004, 8:00 p.m. Eastern time

Earliest Anticipated Start Date: June 1, 2004

#### 17. AWARD DECISIONS

The following will be considered in making award decisions:

Scientific merit as determined by the peer review  
Responsiveness to the requirements of this request  
Performance and use of funds under a previous Federal award  
Contribution to the overall program of research described in this request  
Availability of funds

#### 18. INQUIRIES MAY BE SENT TO:

Dr. Heidi Schweingruber  
Institute of Education Sciences  
555 New Jersey Avenue, NW  
Washington, DC 20208

Email: [Heidi.Schweingruber@ed.gov](mailto:Heidi.Schweingruber@ed.gov)

Telephone: (202) 219-2040

#### 19. PROGRAM AUTHORITY

20 U.S.C. 9501 *et seq.*, the “Education Sciences Reform Act of 2002,” Title I of Public Law 107-279, November 5, 2002. This program is not subject to the intergovernmental review requirements of Executive Order 12372.

#### 20. APPLICABLE REGULATIONS

The Education Department General Administrative Regulations (EDGAR) in 34 CFR parts 74, 77, 80, 81, 82, 85, 86 (part 86 applies only to Institutions of Higher Education), 97, 98, and 99. In addition 34 CFR part 75 is applicable, except for the provisions in 34 CFR 75.100, 75.101(b), 75.102, 75.103, 75.105, 75.109(a), 75.200, 75.201, 75.209, 75.210, 75.211, 75.217, 75.219, 75.220, and 75.230.

#### 21. REFERENCES



National Science Foundation, Division of Science Resources Statistics. (2002). *Graduate students and postdoctorates in science and engineering: Fall 2000*, NSF 02-314. Project Officer, Joan S. Burrelli. Arlington, VA

Research & Policy Committee of the Committee for Economic Development (2003). *Learning for the future: Changing the culture of math and science education to ensure a competitive workforce*. New York, NY: Committee for Economic Development.

U.S. Department of Education, National Center for Education Statistics. (2003). *Digest of education statistics: 2002*, NCES 2003-060. By Thomas D. Snyder. Production Manager, Charlene M. Hoffman. Washington, DC: 2003.